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AUTHOR Kilmer, Donald C.
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ABSTRACT

Designed for the student interested in a vocation in electrical work, this guide, fourth in a set of four, includes three units: Unit X--Splicing Wires, covering thirteen lessons (removing insulation, pigtail splice, Western Union splice, tap splice, extension cord splice, connecting wires to a terminal screw, underwriter's knot, three-wire ground cap, soldering a splice, taping a pigtail splice, taping a tap splice, wire nuts); Unit XI--Grounding, covering two lessons (what is a ground, grounding electrical equipment); and Unit XII--Signal Systems, covering five lessons (pushbutton, simple bell circuit, series bell circuit, parallel bell circuit, bell-circuit jobs). Each lesson includes an objective, vocabulary, information about the lesson, an assignment, and illustrations. (SH)

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State of New Jersey
Department of Education
Division of Vocational Education

Basic Electricity

Part 4

Donald C. Kilmer, Instructor

Philip Cronlund, Superintendent
Marie H. Katzenbach School for the Deaf
West Trenton, New Jersey

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SPlicing WIRES



UNIT X

UNIT X — SPLICING WIRES

Removing Insulation

Lesson 1

OBJECTIVE:

When you have completed this lesson, you will be able to remove insulation from a wire with a pocket knife and prepare the wire for splicing.

VOCABULARY:

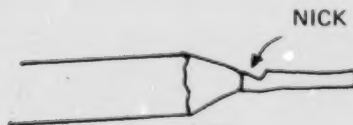
splice (splices) — join wires together

INFORMATION:

Hold knife in your hand as the picture shows you, and remove the insulation.



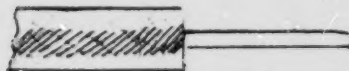
When removing insulation from a wire, do not nick the metal. Nicks will make the wire weak. It may break later.



This is the right way for insulation to be removed from the wire. See the slant on the cut end.



This is how insulation should *not* be removed.



Clean the metal before you make a splice. Use the knife to scrape the wire clean. A dirty wire makes a poor connection.



ASSIGNMENT:

1. Do not _____ the metal when removing the insulation.
2. What tool do you use to clean the copper wire?

3. A dirty wire makes a _____.

UNIT X – SPLICING WIRES

Pigtail Splice

Lesson 2

OBJECTIVE:

When you have completed this lesson, you will be able to make a good *pigtail splice*.

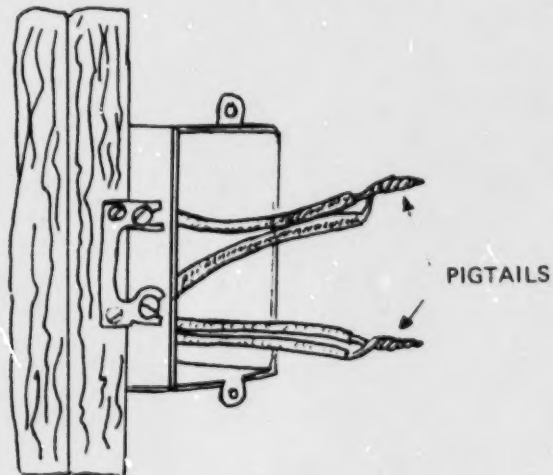
VOCABULARY:

clockwise (klok'-wīz) – in the direction that the hands of a clock
move ↻

INFORMATION:

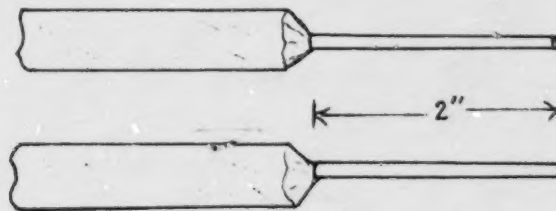
The pigtail splice is made to connect two wires together.

This is a pigtail splice in an outlet box.

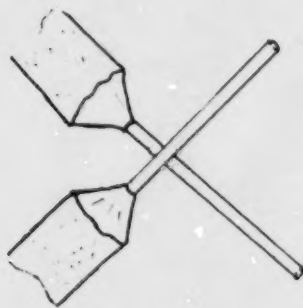


The following steps will show you how to make a good pigtail splice.

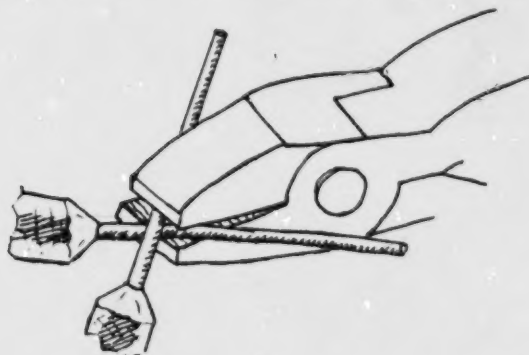
Step 1. Remove 2 inches of insulation from the ends of the wires.



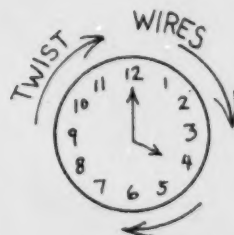
Step 2. Cross the wires like this.



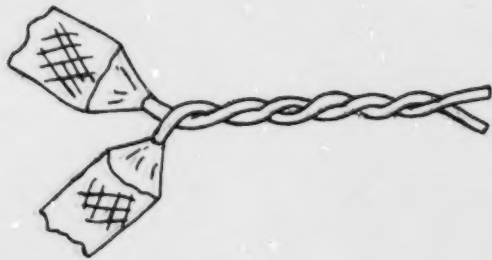
Step 3. Hold the wires with lineman's pliers as shown below.



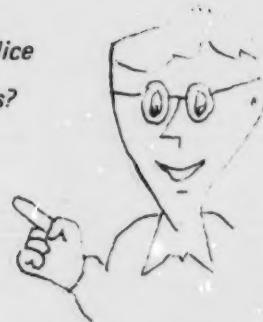
Step 4. Twist in a *clockwise* direction.



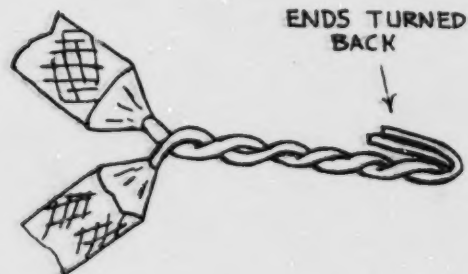
This is a finished splice.



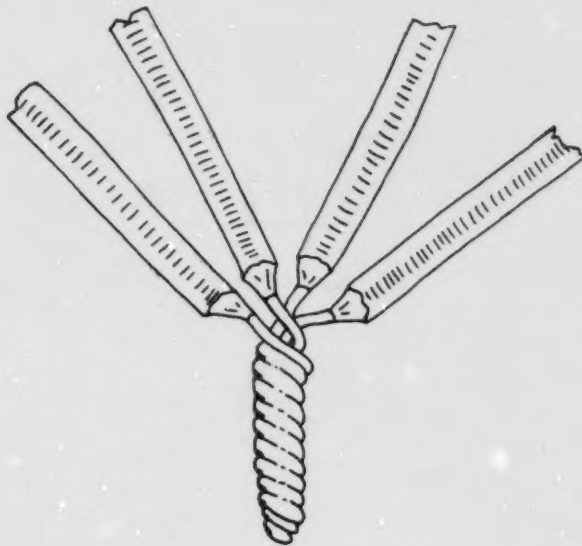
Does your splice
look like this?



If you use tape to insulate the splice, turn the ends of the splice back.
This prevents the wire from sticking through the tape. This could cause a
short circuit.



This is a four-wire pigtail or bunch splice. This splice is often made by electricians.



Pigtail Splice

ASSIGNMENT:

1. Make 6 pigtail splices with #14 solid wire.
2. Make 3 bunch splices.
3. What tools will you use to make these splices?

a. _____

b. _____

UNIT X – SPLICING WIRES

Western Union Splice

Lesson 3

OBJECTIVE:

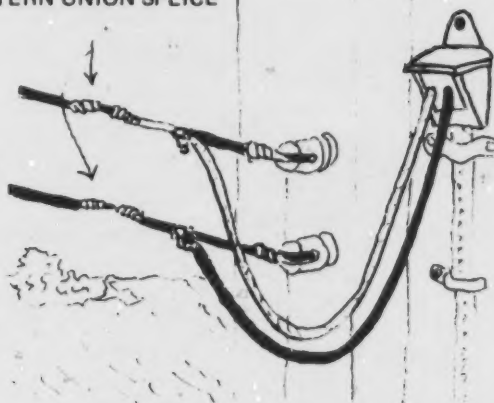
When you have completed this lesson, you will be able to make a good *Western Union* splice.

INFORMATION:

A Western Union splice is used to lengthen a wire or repair a wire that has been broken.

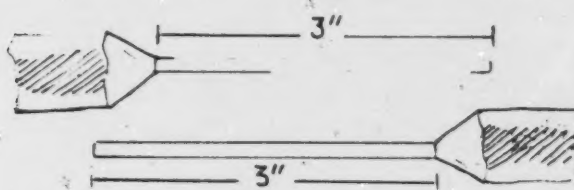
In this lesson the two words to become familiar with are *neck-turn* and *shoulder*.

WESTERN UNION SPLICE



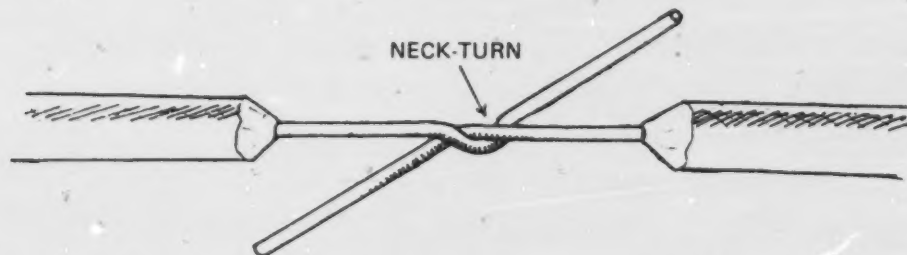
The following steps will show you how to make a good Western Union splice.

Step 1. Remove 3" of insulation from both wires.

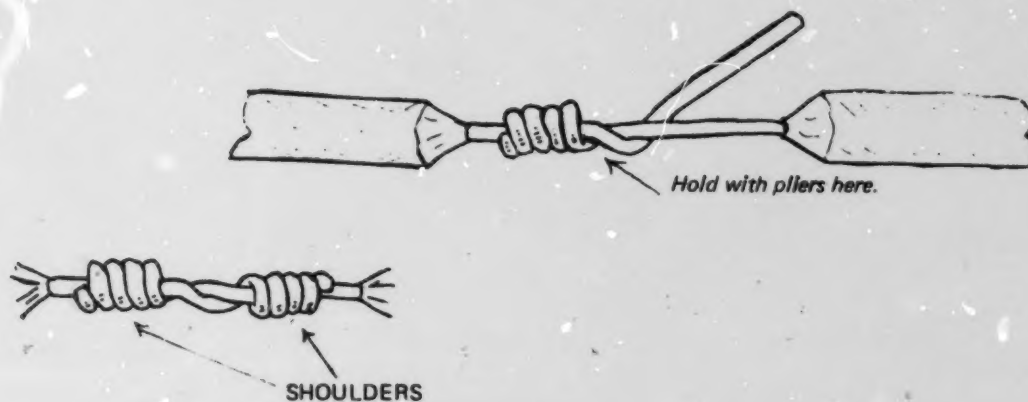


Step 2. Scrape the metal clean with your knife.

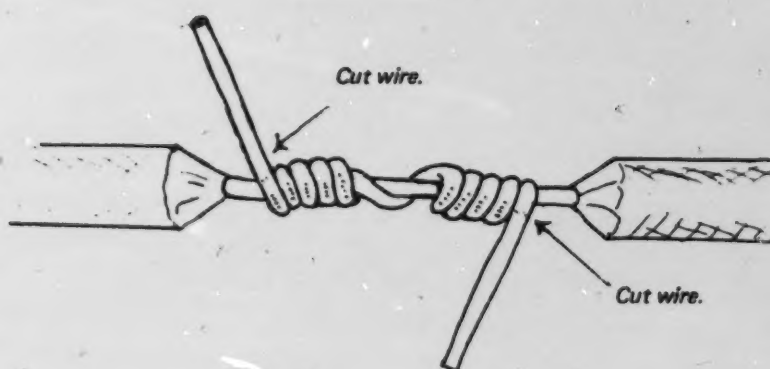
Step 3. Cross the bare wires about 3/4 inches from the insulation and make a *neck-turn*.



Step 4. Make 4 or 5 *shoulders*, using your thumb and forefinger. This is done first on one side then on the other side.



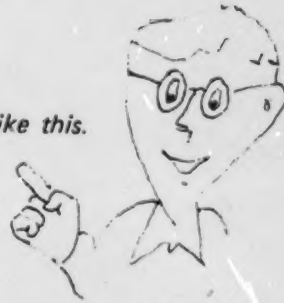
Step 5. Cut the ends off.



This is the finished Western Union splice.



Your splice should look like this.



ASSIGNMENT:

1. Make 6 Western Union splices.
2. At which step do you make a neck-turn?
3. At which step do you make shoulders?

UNIT X – SPLICING WIRES

Tap Splice

Lesson 4

OBJECTIVE:

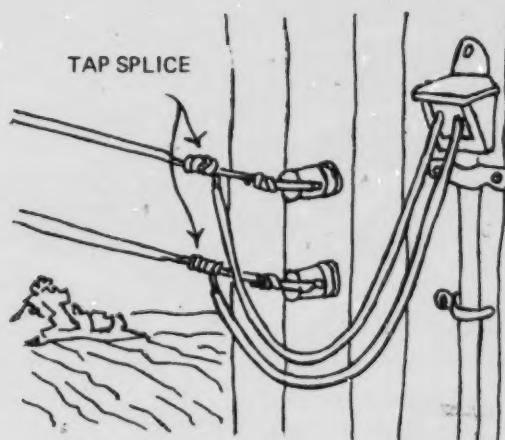
When you have completed this lesson, you will be able to make a good *tap splice*.

INFORMATION:

A tap splice is used to make a connection anywhere along the length of another wire.

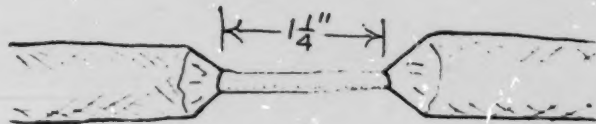
A tap splice is one half of a Western Union splice.

A tap splice also has a neck-turn and shoulders.

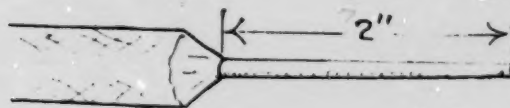


The following steps will show you how to make a tap splice.

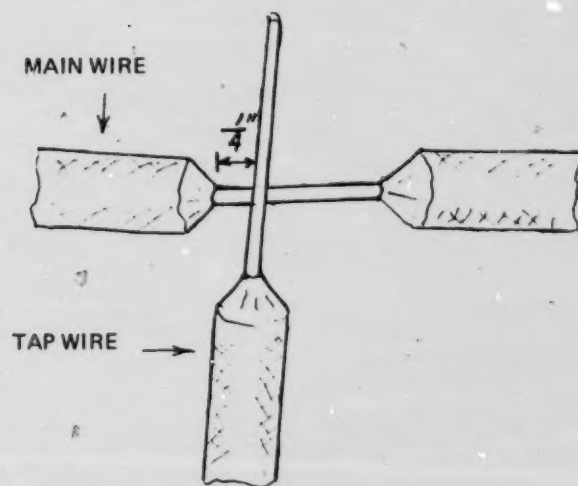
Step 1. Remove $1\frac{1}{4}$ inches of insulation from the main wire. Clean the metal with your knife.



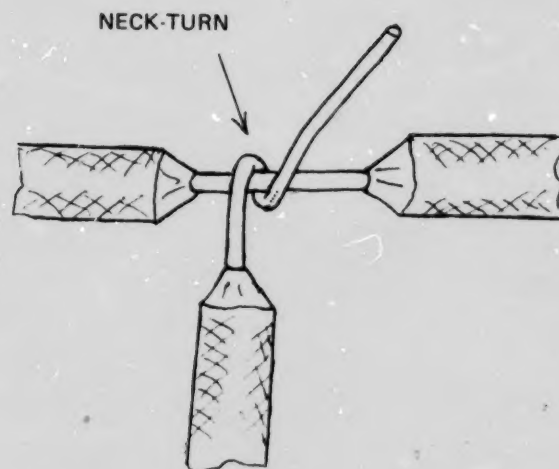
Step 2. Remove 2 inches of insulation from the end of the tap wire. Clean the wire.



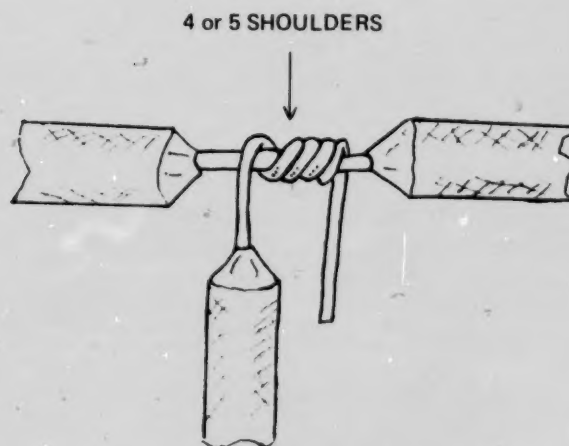
Step 3. Cross wires as shown below.



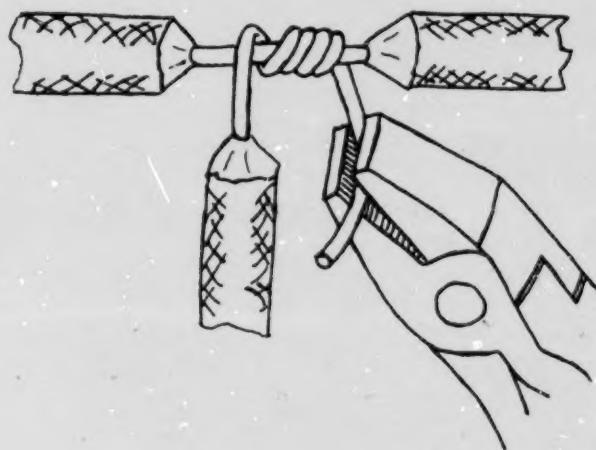
Step 4. Make a neck-turn.



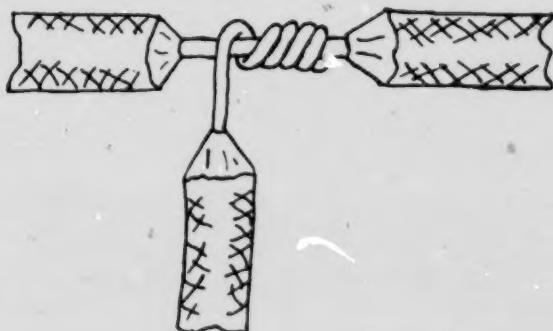
Step 5. Make 4 or 5 shoulders with your fingers. Follow the neck-turn right around.



Step 6. With a pair of lineman's pliers, tighten shoulder turns. Cut off extra wire.



Step 7. Check. You don't want sharp wires. This is a finished tap splice.



Tap Splice

*Does your splice
look like this?*



ASSIGNMENT:

1. A tap splice is one half of a _____

2. Make 6 tap splices.

UNIT X — SPLICING WIRES

Extension-Cord Splice

Lesson 5

OBJECTIVE:

When you have completed this lesson, you will be able to make an *extension-cord splice*.

VOCABULARY:

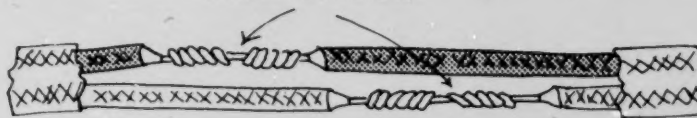
staggered (stag'-ərd) — zig-zag; not in a straight line; not exactly opposite.

Extension cords are made of standard wires.

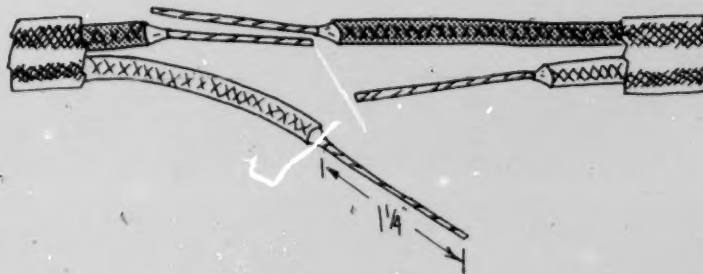
INFORMATION:

When making an extension-cord splice, keep the splices *staggered* to prevent a short circuit.

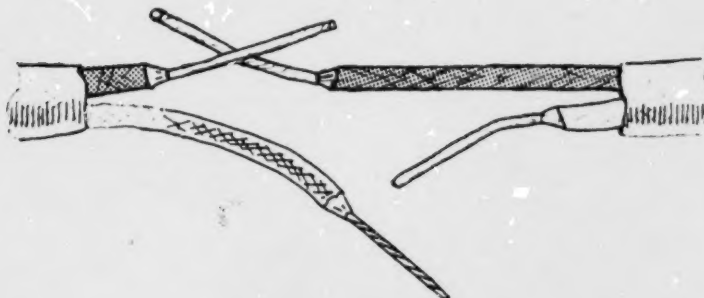
STAGGERED WIRES



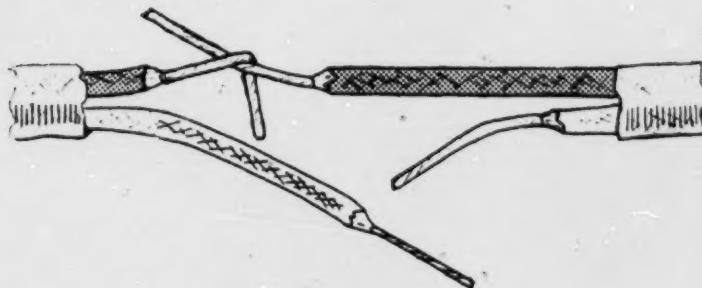
Step 1. Remove about $1\frac{1}{4}$ inches of insulation from the wires. Stagger the cuts!



Step 2. Cross two wires. Make sure you follow the colors -- black to black or white to white.



Step 3. Make a neck-turn as you did in the Western Union splice.



Step 4. Make a Western Union splice by making shoulders.



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Step 5. Do the same with the other pair of wires. When you are finished your splice should look like this.



Extension Cord Splice

Does your splice look
like this?



ASSIGNMENT:

1. Make 3 extension cord splices.
2. The most important thing to remember about extension-cord splicing is to _____ the splice.

UNIT X – SPLICING WIRES

Connecting Wires to a Terminal Screw

Lesson 6

OBJECTIVE:

When you have completed this lesson, you will be able to connect a wire to a terminal screw.

INFORMATION:

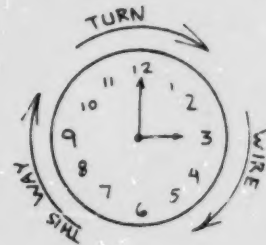
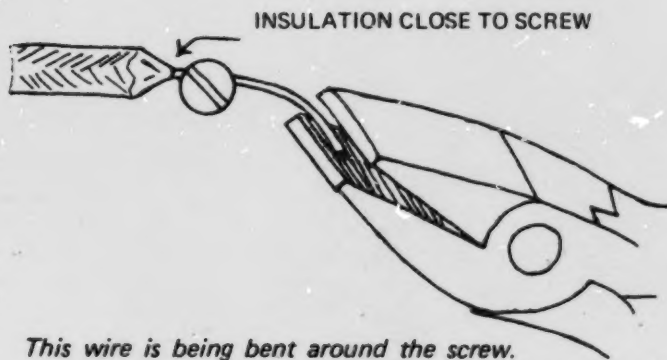
When you connect a wire under a terminal screw, bend the wire in a clockwise direction. This is the same direction that tightens the screw.



Step 1. Remove about 1" of insulation from the end of a solid wire.



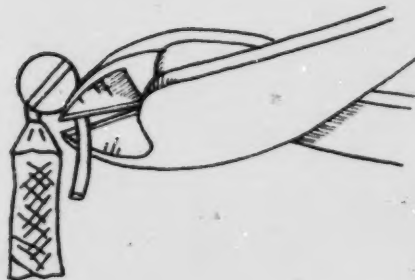
Step 2. Use the pliers to bend the wire around the screw. Bend in a clockwise direction.



INSULATION CLOSE TO SCREW



Step 3. With diagonal pliers, cut off the end of the wire. Bend the wire in toward the screw.



Step 4. Tighten the screw.



Wire Connected to
Screw

Does your wire fit like this?



ASSIGNMENT:

1. Put an arrow on this circle to show the clockwise direction.



2. What is the name of the pliers used to bend the wire around the screw?

3. What is the name of the pliers used to cut the wire?

UNIT X – SPLICING WIRES

Underwriter's Knot

Lesson 7

OBJECTIVE:

When you have completed this lesson, you will be able to make the *underwriter's knot*.

VOCABULARY:

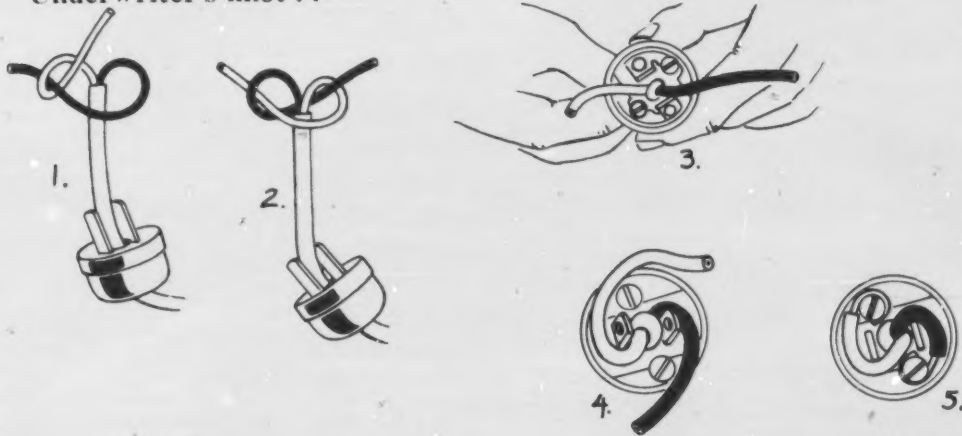
prong — a narrow part of a thing that sticks out

INFORMATION:

An underwriter's knot is used only on two-wire cords with a two-prong end cap. The underwriter's knot keeps the cord from being pulled through the end cap.

Study steps 1 through 5 below.

Underwriter's knot . .



ASSIGNMENT:

1. Make 6 underwriter's knots.
2. The underwriter's knot keeps the cord from being pulled through the _____.

UNIT X - SPLICING WIRES

3-Wire Ground Cap

Lesson 8

OBJECTIVE:

When you have completed this lesson, you will be able to attach a 3-wire cord to a grounding cap.

VOCABULARY:

brass (bras) — a gold-color metal

INFORMATION:

The 3-wire ground cap protects you from getting an electric shock.

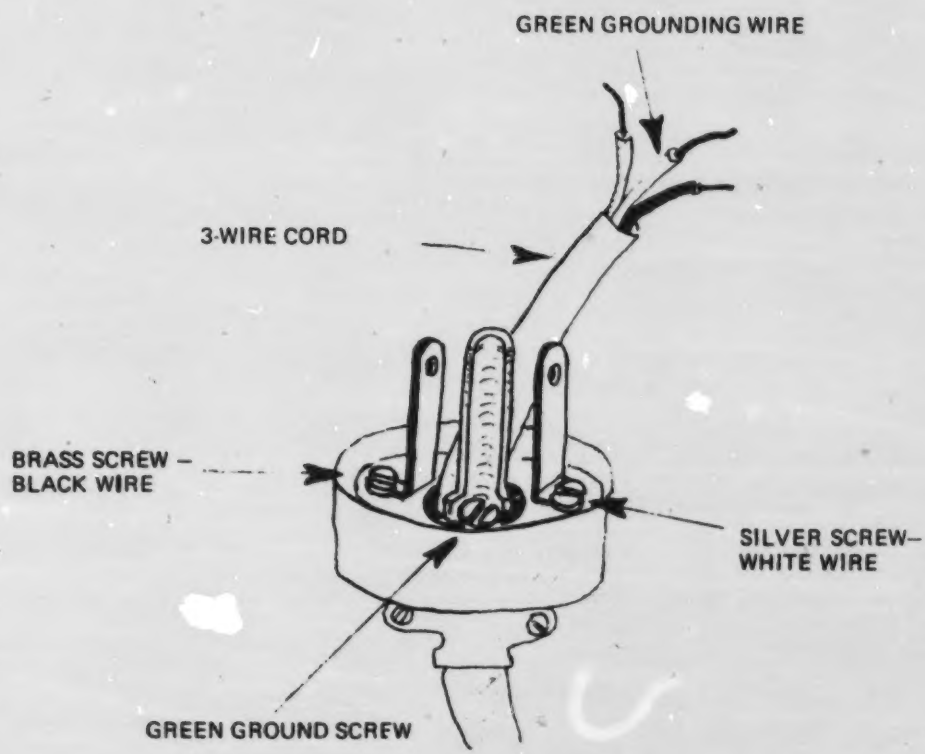
If a hot wire shorts against any metal part of an appliance, the large current flows through the green wire into the ground — not into your body.

The following picture of the 3-wire ground cap shows how to attach a 3-wire cord to the cap.

The green wire is always connected to the green screw terminal.

The white wire is always connected to the silver screw terminal.

The black wire is always connected to the brass screw terminal.



3-Wire Grounding Cap

ASSIGNMENT:

1. What color wire is connected to the silver terminal? _____
2. What color wire is connected to the green terminal? _____
3. What color wire is connected to the brass terminal? _____
4. What is the name of the green wire? _____
5. What is the name of the cord you use? _____
6. What is the purpose of the grounding wire?
7. Attach a 3-wire cord to a grounding cap.

UNIT X – SPLICING WIRES

Soldering a Splice

Lesson 9

OBJECTIVE:

When you have completed this lesson, you will be able to solder any type of splice.

VOCABULARY:

solder (sod' ər) — to make a good joint by melting a soft metal into the place. The soft metal is also called solder.

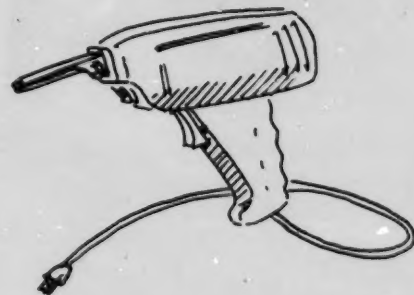
INFORMATION:

The purpose of soldering a splice is to make a good connection. A loose splice will make the wires hot and spoil the connection.

Loose splices can cause sparks and even fires.

These are the materials you will need for soldering. You will need flux, solder, and a soldering gun.

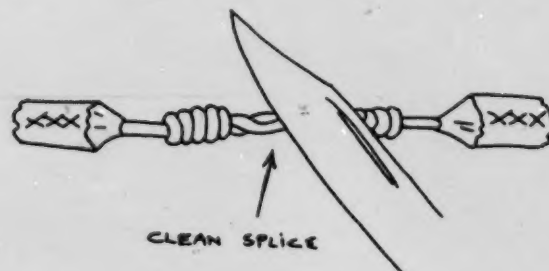
Flux is a paste to help the solder stick to the splice. The soldering gun gives the heat.



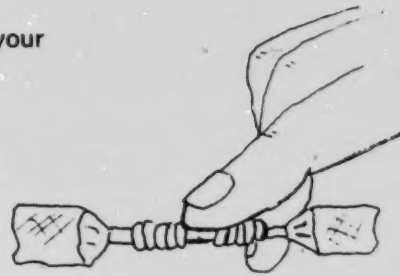
Step 1. Heat your soldering gun.



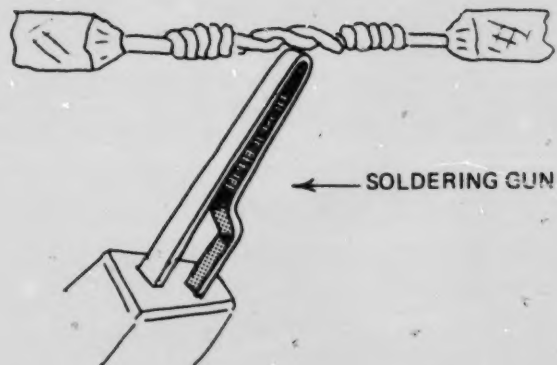
Step 2. Clean splice before you solder. A pocket knife will work well. Scrape the bare wire until it becomes bright in color.



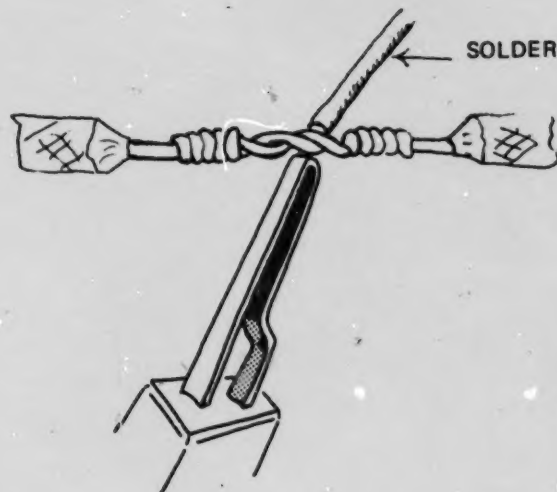
Step 3. Put the flux on the splice with your finger.



Step 4. Hold your hot soldering gun under the splice. Make sure the gun is touching the splice.



Step 5. Keep the gun under the splice. Start your soldering on the top of the splice.



Step 6. Let the solder melt between the shoulders. Then spread it over the whole splice.

This is a finished splice.



Finished Splice

REMEMBER:

1. Clean splice.
2. Put on flux.
3. Heat splice.
4. Solder splice.
5. Solder must melt through and over splice.



ASSIGNMENT:

1. A loose splice will make the wires _____.
2. A loose splice can cause a _____.
3. Flux helps the solder _____ to the splice.
4. You must hold the soldering iron _____ the splice.
(over, under)
5. The solder must melt between the _____. Then
_____ it over the rest of the splice.
6. Solder the splices you have made.

UNIT X — SPLICING WIRES

Taping a Pigtail Splice

Lesson 10

OBJECTIVE:

When you have completed this lesson you will be able to tape a pigtail splice.

VOCABULARY:

match (mach) — be just like; be equal to (something else)

wrap (rap) — cover by putting something all around.

overlap (ō-var-lap') cover up part of something and also stick out beyond it.

INFORMATION:

To tape a splice is to wrap a tape around the bare wires.

When taping a pigtail splice you must be careful of the end of the splice. The end must be protected with enough tape so it will not show through. This could cause a short circuit.

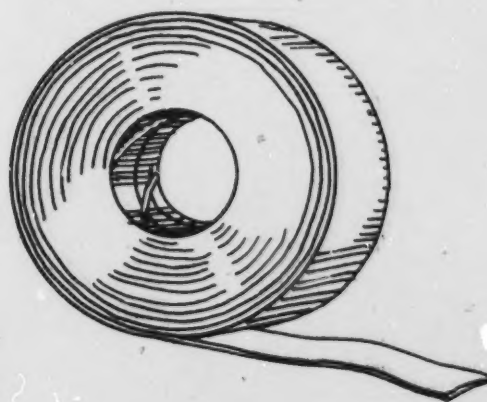
Below is a picture of a finished splice. See how the end is bent back. This is to prevent it from cutting through the tape.



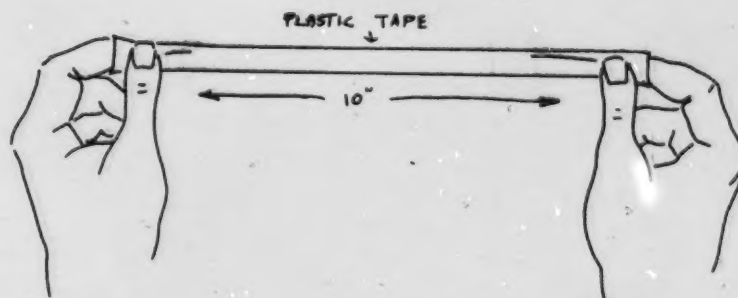
When you are finished taping your splice, it should look like the one below.
The tape should equal the insulation on the wire.



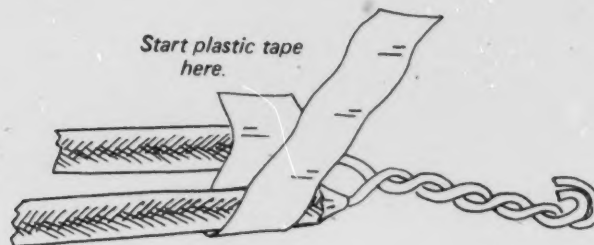
Here is a roll of plastic electrical tape. This tape is used for most splices. It is a form of insulation that matches the insulation on the wires.



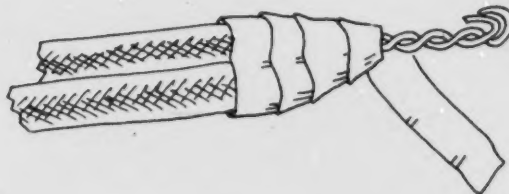
Cut off about 10 inches of the plastic tape.



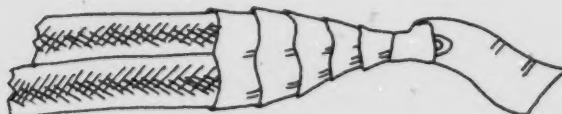
Start the tape between the wires, as shown below.

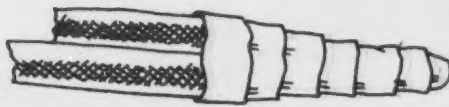


Squeeze the wires together and continue to wrap the tape around the splice. Overlap the tape each turn.



At the end of the splice, bring the tape out and over the end. It must cover the end completely. Overlap the tape and wrap it back to the beginning.





This is the finished taped pigtail splice.

ASSIGNMENT:

Tape all the pigtail and bunch splices you have made.

UNIT X – SPLICING WIRES

Taping a Western Union Splice

Lesson 11

OBJECTIVE:

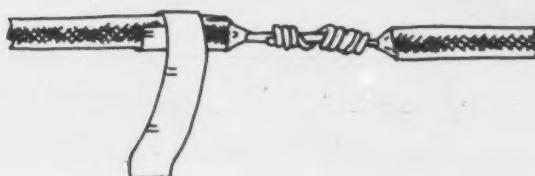
When you have completed this lesson, you will be able to tape a Western Union splice.

INFORMATION:

A Western Union splice has no wire ends to worry about.

Tape the splice so that the tape equals the insulation covering the wire.

Cut about 12" of plastic tape from the roll and start it on the wire, as the picture shows.



Wrap the tape around the splice, lapping the tape as you go. See picture.



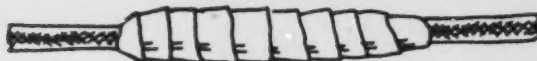
281

Continue to wrap the splice, stretching the tape slightly to get a good, tight tape job.

You must have enough tape to wrap the splice twice. Wrap once to the right and once to the left.



When you finish, the splice should look like this.



ASSIGNMENT:

Tape all the Western Union splices you have made.

UNIT X – SPLICING WIRES

Taping a Tap Splice

Lesson 12

OBJECTIVE:

When you have completed this lesson, you will know how to tape a tap splice.

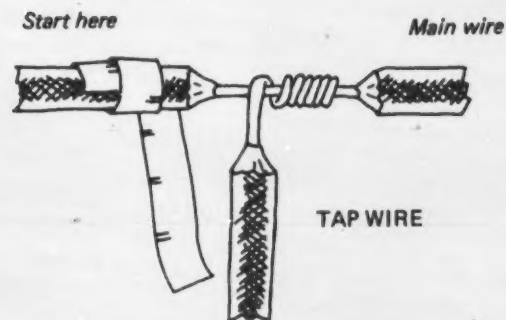
INFORMATION:

A tap splice is a combination of a Western Union and a pigtail splice.

You need a little extra practice to tape this splice well.

Always make sure the tape equals the insulation on the wire.

Cut about 12" from the roll and start your tape as the picture shows.

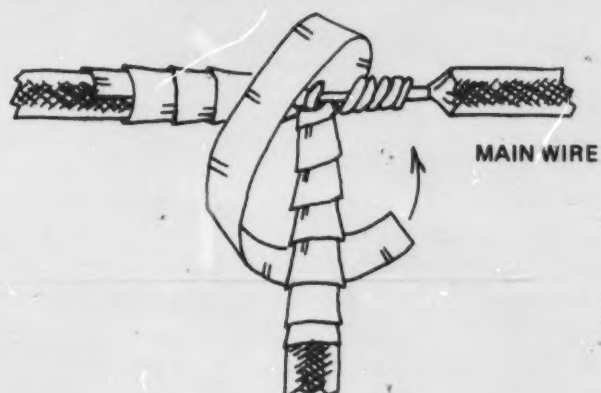


Wrap the main wire as far as the tap wire.

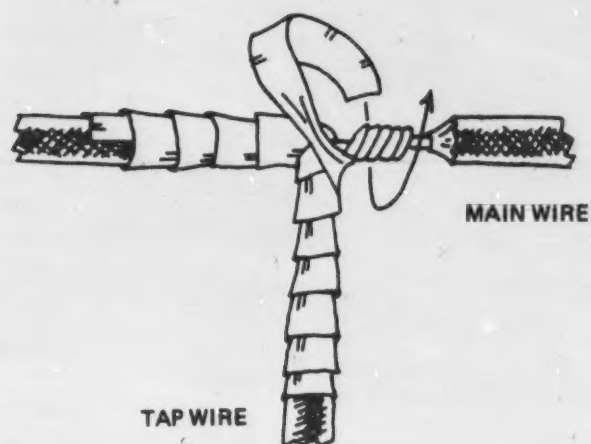
Wrap down the tap wire and back up.

Wrap the tape over itself, up to the main wire.

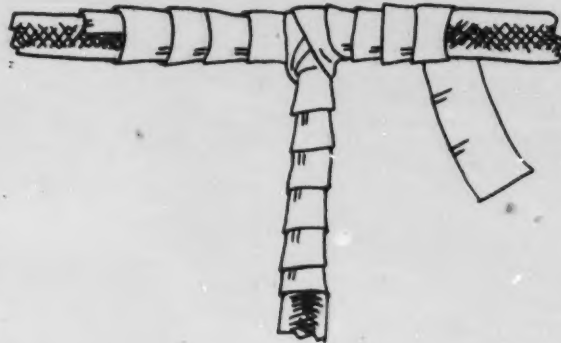
Bring the tape up from behind and over and down in front. See picture.



Bring tape up and behind tap wire and over the main wire.

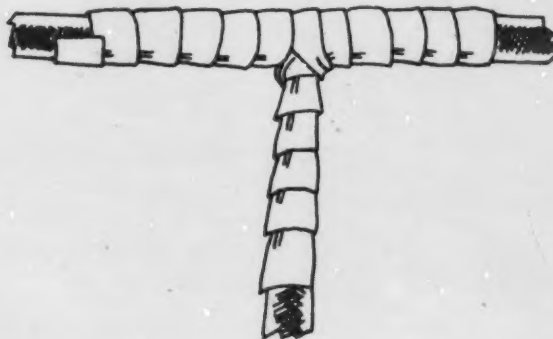


Continue to wrap the tape along the main wire, keeping the tape pulled tight at all times. Overlap as you go.



Now wrap back on the main wire in the other direction.

The picture below shows what your splice should look like when you finish.



ASSIGNMENT:

Tape all the tap splices you have made.

UNIT X – SPLICING WIRES

Wire Nuts

Lesson 13

OBJECTIVE:

When you have completed this lesson, you will be able to use a wire nut to connect wires.

VOCABULARY:

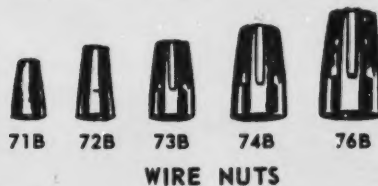
even (ē'-vən) — the same; equal

INFORMATION:

Wire nuts are used to connect two or more wires together. They take the place of solder and tape. They save time and money.

Some of the different sizes of wire nuts are shown below.

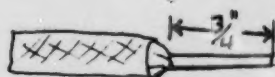
Solderless—Tapeless Wire Connectors



This drawing shows the inside of a wire nut.

How to prepare wire for wire nuts —

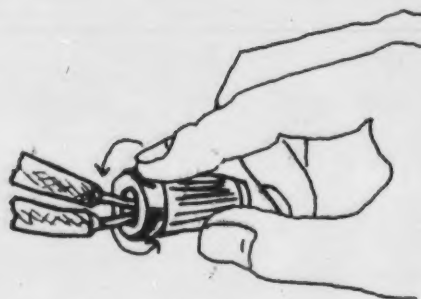
Step 1. Remove $\frac{3}{4}$ inch of insulation from wire as shown.



Step 2. Put the two stripped wires together. Make them even at the ends.



Step 3. Put the wire nut over the stripped wires and turn the nut clockwise.



Step 4. Keep turning the wire nut. Make it tight. Try not to have any bare wire showing.



*If your job looks like this,
it's OK.*



ASSIGNMENT:

1. Wire nuts are used to make a _____.
2. Wire nuts take the place of _____ and _____.
3. Wire nuts must be turned _____ to tighten them.
4. The ends of the wires must be _____ before you put the wire nut on.
5. Wire nuts save _____ and _____.

UNIT XI



GROUNDING

UNIT XI – GROUNDING

What Is a Ground?

Lesson 1

OBJECTIVE:

When you have completed this lesson, you will know what a ground is.

VOCABULARY:

contact (kon'-takt) — to touch; a touching of something.

sheathing (shēth'-ing) — a covering.

branch — a smaller part coming from a large part, like the branch of a tree.

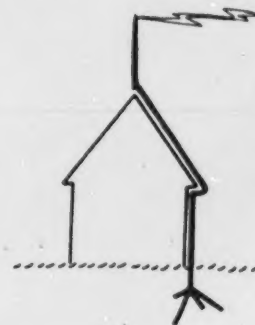
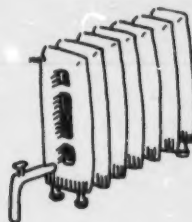
case (kās) — outside covering of a motor, machine, or appliance.

INFORMATION:

A ground is an electrical connection to the earth.

Most often it is a *connection to a pipe that goes into the earth* and makes a good contact with the earth.

A cold-water pipe is a very good ground connection.



Some Grounds

Power lines coming into a house must be grounded.

• All branch circuits must be grounded.

The metal sheathing of BX cable must be grounded.

Aerials for radio and TV must be grounded.

Metal boxes for electrical connections must be grounded.

The metal cases of *all electrical appliances should be grounded*. Sometimes small appliances are not grounded. We will see in the next lesson what can happen.

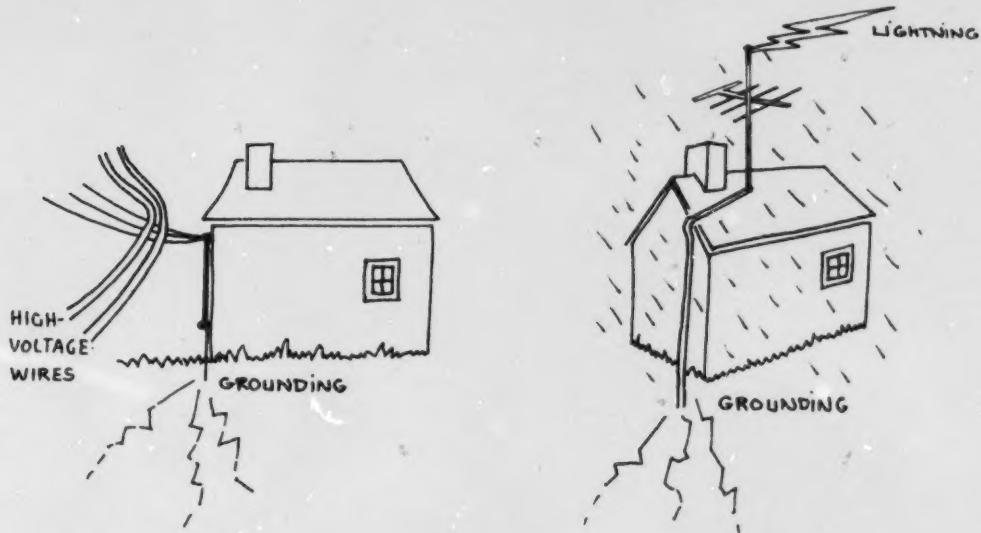
Why is grounding needed?

Grounding can

- (1) Prevent electrical fires.
- (2) Save your life.

The earth we live on is a very fine conductor of electricity. It protects our buildings and ourselves.

Suppose lightning strikes a house. Or suppose a high-voltage electric line falls and makes contact with the wires running into the house. The grounding will conduct the electricity into the earth and there will be no damage.



Grounding protects your house from fires.

Without grounding, there could be a fire.

Without grounding, a person inside the house could get killed from an electric shock.

ASSIGNMENT:

1. What is a ground?

2. Name two good grounds.
 - a. _____
 - b. _____
3. Name five things in a house electrical system that must be grounded.
 - a. _____
 - b. _____
 - c. _____
 - d. _____
 - e. _____
4. Grounding can prevent _____.
5. Grounding can save your _____.

UNIT XI – GROUNDING

Grounding Electrical Equipment

Lesson 2

OBJECTIVE:

When you have completed this lesson you will know what can happen when electrical equipment is not grounded.

You will know how grounding protects the user.

VOCABULARY:

equipment (i-kwip'-mənt) – tools, appliances, small machines, etc.

user (ū'-zər) – a person who uses something.

frame (frām) – strong metal part that holds the moving parts of a tool or appliance.

portable (pōr'-tə-bl) – easy to carry around.

hazard (haz'-ərd) – a danger; something that can easily cause an accident.

defective (di-fek'-tiv) – having something wrong; not made right.

receptacle (ri-sep'-tə-kl) – a small box to push electrical plugs or caps into, to connect with an electrical circuit.

prong – a small pointed thing that sticks out.

INFORMATION:

As we said in the last lesson, the metal cases of all electrical equipment should be grounded. Why?

Usually, electrons stay in the wires where they belong. But sometimes insulation gets damaged or rubbed off. Then the electrons flow from the wires

to any other conductor contacting the wires. This could be the metal frame or case of the appliance.

Often this can happen and the appliance will still work. You may use the appliance and never know that there is something wrong with it.

One day you may touch the appliance and touch the ground (like a faucet) at the same time. *If the appliance has not been grounded*, the electric current will go right through your body and down into the ground.

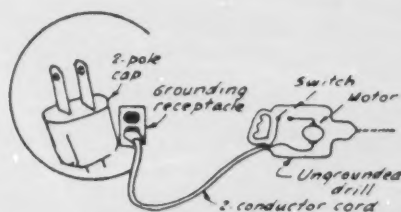
You may be hurt or even killed.



If the appliance *has* been grounded, you will not feel anything!

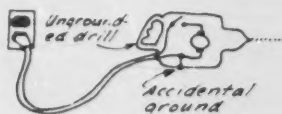
When there is contact between the metal wires of a machine and the frame or casing, this is sometimes called an *accidental ground*.

Here is a diagram of a portable electric drill. This is the sort of tool that is easily damaged. It is not grounded.



The next diagram shows a drill with damaged insulation. Current can flow from a hot motor wire to the metal case. The case will become "hot" too. It has an accidental ground in it.

Often the drill will still work, and you will not know it is a hazard.



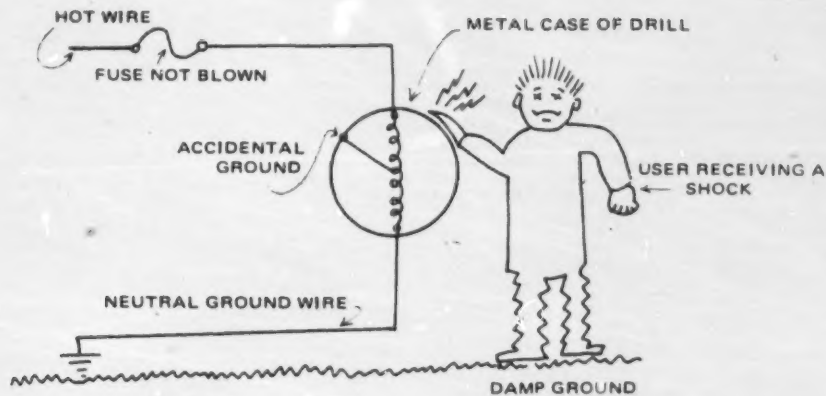
ACCIDENTAL GROUND

One day you may pick it up while standing on a damp cellar floor or touching a ground. Then — zap! You get a big shock!



SHOCK HAZARD

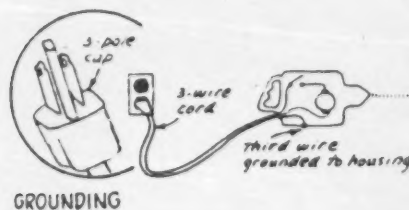
The picture below shows how this happens. The electric circuit is grounded, but the metal case of the drill is not.



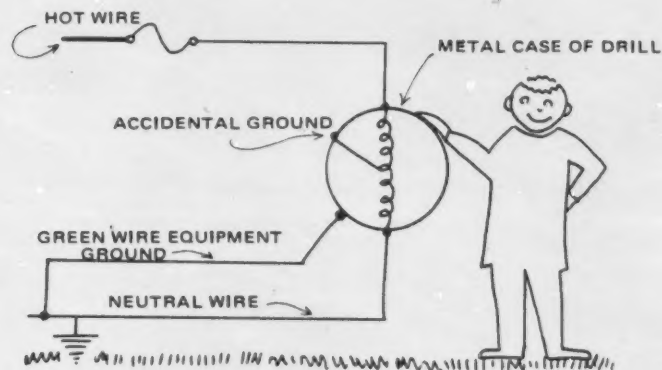
The current flows from the hot wire through the *accidental ground* to the case of the drill, *through the user*, and into the damp ground.

If the voltage is high enough, the user can get killed. If not, he will get a terrible shock and a burn.

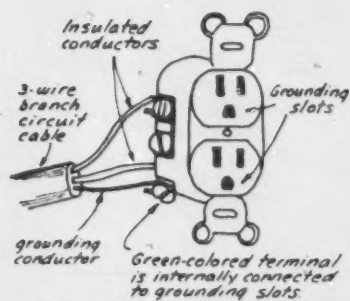
The picture below shows how a drill should be wired. Attached to the drill is a three-wire cord and end cap. The third (green) wire is *connected inside to the metal case (housing) of the drill*.



The user — shown below — is now protected against an electric shock.



If an accidental ground happens, current flows to the metal case of the drill, through the green equipment ground wire, and into the earth. This is a safe installation.



GROUNDING RECEPTACLE

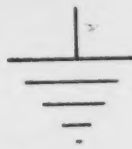
The picture above is a grounding receptacle. The U-shaped opening is for the third prong on the 3-wire end cap. (See Unit X, Lesson 8, page 269.)

This third prong is the *equipment grounding connection* between your appliance and the continuous equipment ground in your home, factory, or store.

You should know that even *new* appliances are sometimes defective. It is just as important to ground a new tool as an old tool.

For safety, all of the receptacles should be the three-wire type as shown before. If they are not, there are other ways to ground large appliances.

This symbol indicates a connection to ground.



ASSIGNMENT:

1. Equipment grounds protect you from _____.
 - a. drilling mistakes
 - b. power loss
 - c. electrical shock
 - d. three wire
2. Equipment grounds should be connected to _____ cases and frames of tools and appliances.
 - a. wood
 - b. plastic
 - c. 3-wire
 - d. metal
3. When an uninsulated hot wire touches the metal case of a drill, it is called an _____.
 - a. ungrounded drill
 - b. open circuit
 - c. accidental ground
 - d. electric receptacle
4. If a high-voltage current flows through a person, it will usually _____ him.
5. The easiest way to protect a home is with three-wire _____.

6. What color is the equipment ground wire in a three-wire cord?

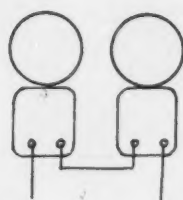
7. What kind of end cap should be connected to the three-wire cord of a drill? _____
- a. Two-wire
 - b. Three-wire
 - c. Bare wire
 - d. U-shaped _____
8. Draw a picture of a ground symbol.
9. True or False? If electrical equipment is new, you can be sure it is safe to use without grounding. _____

SIGNAL SYSTEMS

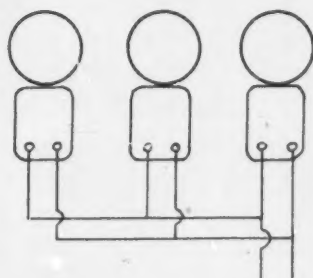
1.



2.



3.



PUSHBUTTON
SERIES
PARALLEL

UNIT XII

UNIT XII – SIGNAL SYSTEMS

Pushbutton

Lesson 1

OBJECTIVE:

When you have completed this lesson, you will know how the pushbutton is used to control a bell circuit.

VOCABULARY:

control (kən-trōl') – to have power over something; to hold something back and start again.

INFORMATION:



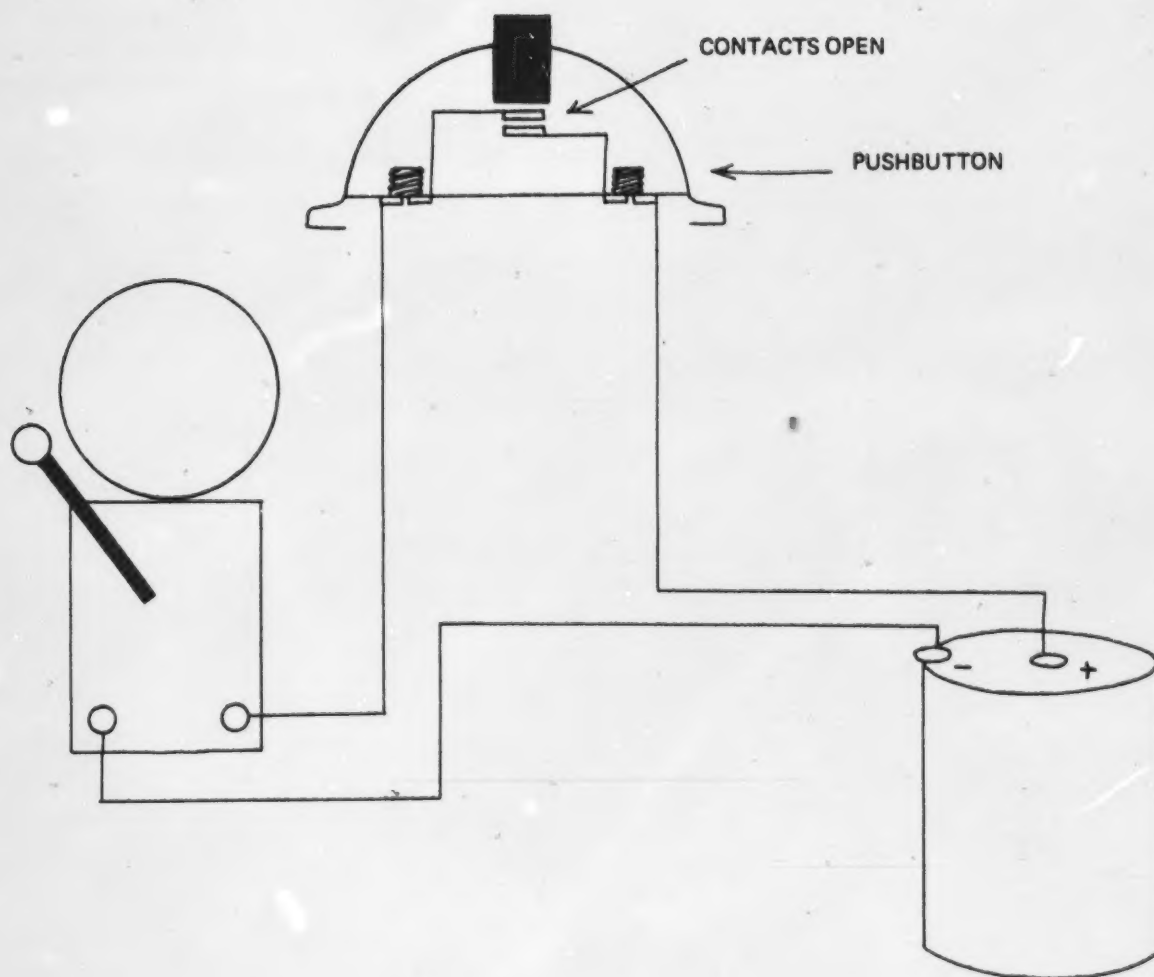
A pushbutton is used as a switch.

If you push it, electricity moves through it.

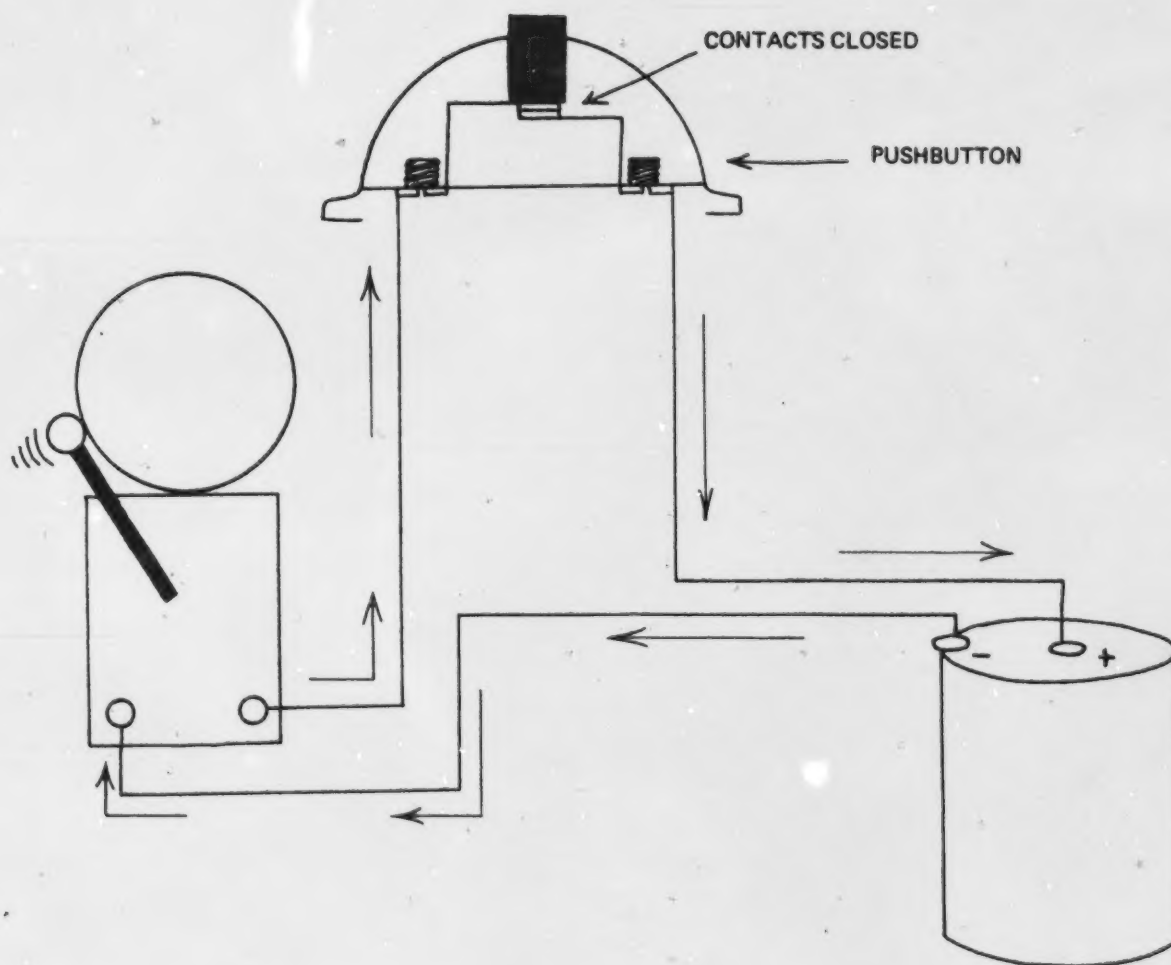
If you stop pushing it, the electricity will stop.

The pushbutton *controls* the electricity.

Look at this drawing. Electricity does not move through the pushbutton.
The contacts are *open*. The bell does not ring.



Now, look at this drawing. The pushbutton contacts are closed. Electricity is moving through the bell circuit. The bell is now ringing.



ASSIGNMENT:

1. A pushbutton is used as a _____.
2. If the pushbutton contacts are closed, the electricity _____.
 - a. stops
 - b. moves
 - c. drops
 - d. contacts
3. A pushbutton _____ the bell circuit.
 - a. acquaints
 - b. circuits
 - c. controls
 - d. terminals
4. If the pushbutton contacts are _____, the circuit will work.
5. If the pushbutton contacts are _____, the circuit will not work.

UNIT X — SIGNAL SYSTEMS

Simple Bell Circuit

Lesson 2

OBJECTIVE:

When you have completed this lesson, you will be able to set up a simple bell circuit.

VOCABULARY:

simple (sim'pl) — easy to do or understand.

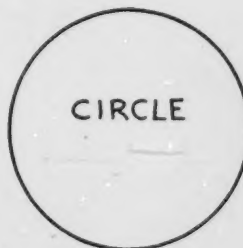
INFORMATION:

An easy way to understand a simple bell circuit is to draw a circle.

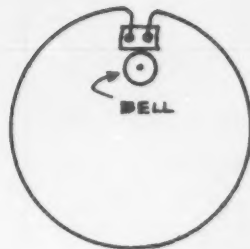
Add a bell, a pushbutton, and a transformer.

With this simple circle you can plan a working bell circuit.

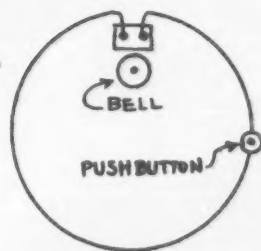
First we draw the circle.



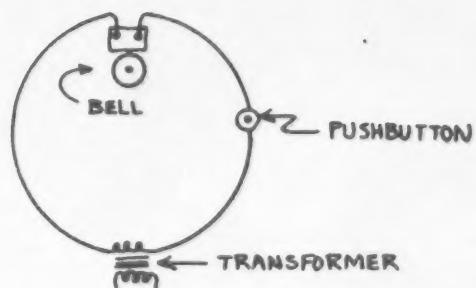
Add a bell to the circle.



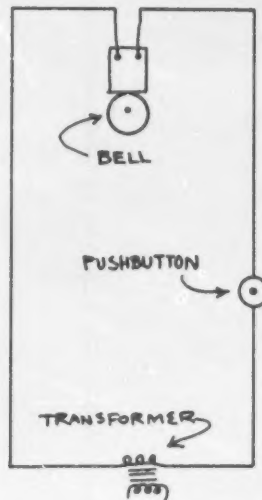
Now we need a pushbutton (the switch).



Then add the transformer.



Electrical wiring diagrams are always drawn with straight lines. The drawing below shows the bell, pushbutton, and transformer in the same circuit but using straight lines.



Simple Bell Circuit

ASSIGNMENT:

1. Draw a simple bell circuit. Use the circle method.
2. Draw a simple bell circuit with straight lines.
3. Make a bell circuit on your wiring board.
Use a bell, pushbutton, and transformer.

UNIT X – SIGNAL SYSTEMS

Series Bell Circuit

Lesson 3

OBJECTIVE:

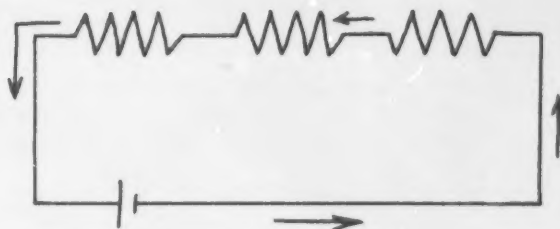
When you have completed this lesson, you will be able to build your own series bell circuit.

VOCABULARY:

path – a line that something moves on

INFORMATION:

You know that in a series connection there is only one path for the electricity to follow. Here is a diagram of a series circuit. It will remind you you what a series circuit is like.

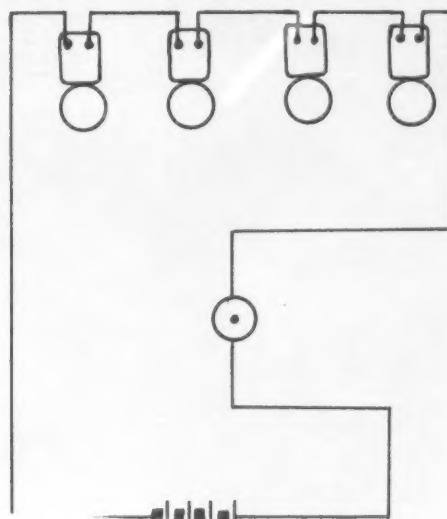


In a series bell circuit, a wire is connected from one terminal of the battery to the pushbutton.

Then, a wire is connected from the pushbutton to the first bell.

Wires connect each bell to the next, as shown in the diagram.

A wire is connected from the last bell to the other terminal on the battery.



A Series Bell Circuit

ASSIGNMENT:

1. Draw a series bell circuit using 2 bells.
2. Draw a series bell circuit using 3 bells.
3. Make a series bell circuit on your wiring board using 4 bells, one pushbutton, and one transformer.
4. What happens when you press the pushbutton?
5. Disconnect one wire of one bell.

What happens when you press the pushbutton?

Why does this happen?

UNIT X – SIGNAL SYSTEMS

Parallel Bell Circuit

Lesson 4

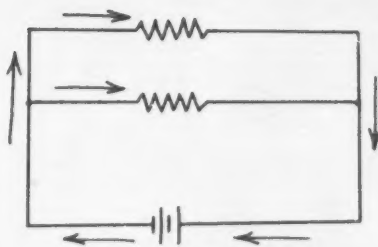
OBJECTIVE:

When you have completed this lesson, you will be able to build your own parallel bell circuit.

INFORMATION:

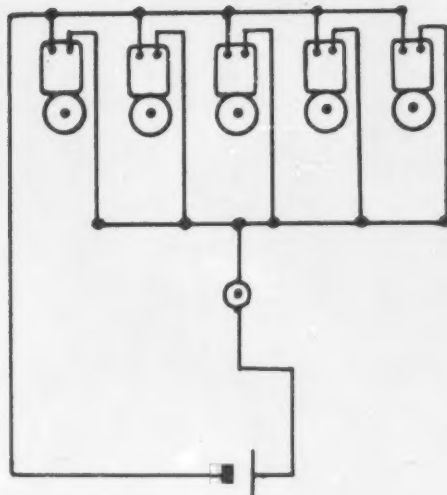
You know that a parallel circuit has more than one path for the electricity to follow.

Here is a picture of a parallel circuit. It will remind you what a parallel circuit is like.



The electricity takes two paths. Each load is on its own path.

All five of the bells in the following picture will ring at the same time when the pushbutton is pushed.

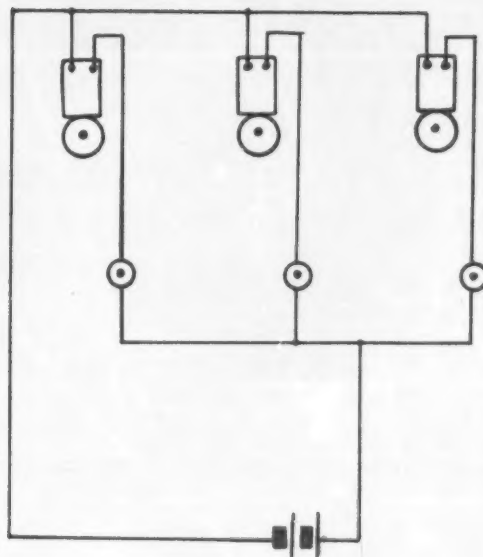


The five bells connected in parallel are controlled by one pushbutton.

Trace the five paths that the electricity will follow when the pushbutton is pressed.

In this diagram, you have three bells in parallel. Each bell has a pushbutton.

Only one bell will ring when you press a pushbutton.



These are three bells connected in parallel. Each bell is controlled by a pushbutton.

Trace the path that the electricity will follow when the first pushbutton is pressed.

Do the same for the second pushbutton.

Do the same for the third pushbutton.

ASSIGNMENT:

1. Draw a parallel bell circuit with 2 bells controlled by one pushbutton.
2. Make a 2-bell parallel circuit on your wiring board. Control both bells with one pushbutton. Use a transformer.
3. What happens when you press the pushbutton?
4. Disconnect one wire from one bell. Press the pushbutton. What happens?

Why does this happen?

5. Draw a parallel bell circuit with 3 bells. Control each bell with a pushbutton.
6. Make a 3-bell parallel circuit on your wiring board. Control each bell with a pushbutton. Use a transformer.
7. Disconnect one wire from one bell. What happens when you press its button?

Do the other bells work? Why?

UNIT X – SIGNAL SYSTEMS

Bell-Circuit Jobs

Lesson 5

OBJECTIVE:

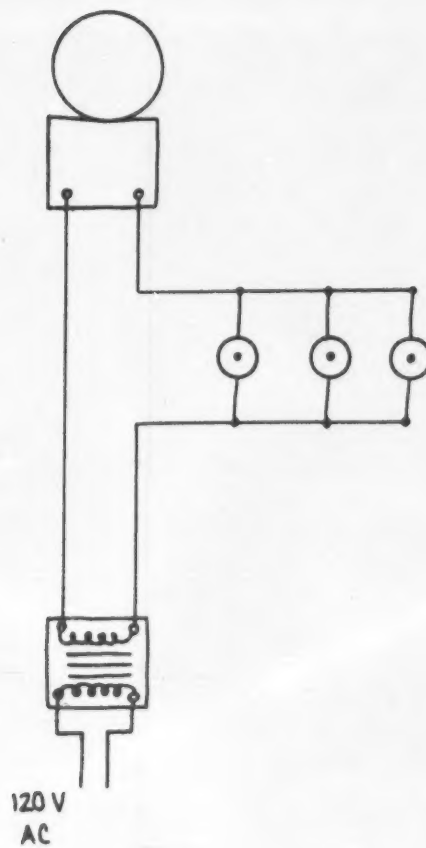
When you have completed this lesson, you will be able to build bell circuits from wiring diagrams.

INFORMATION:

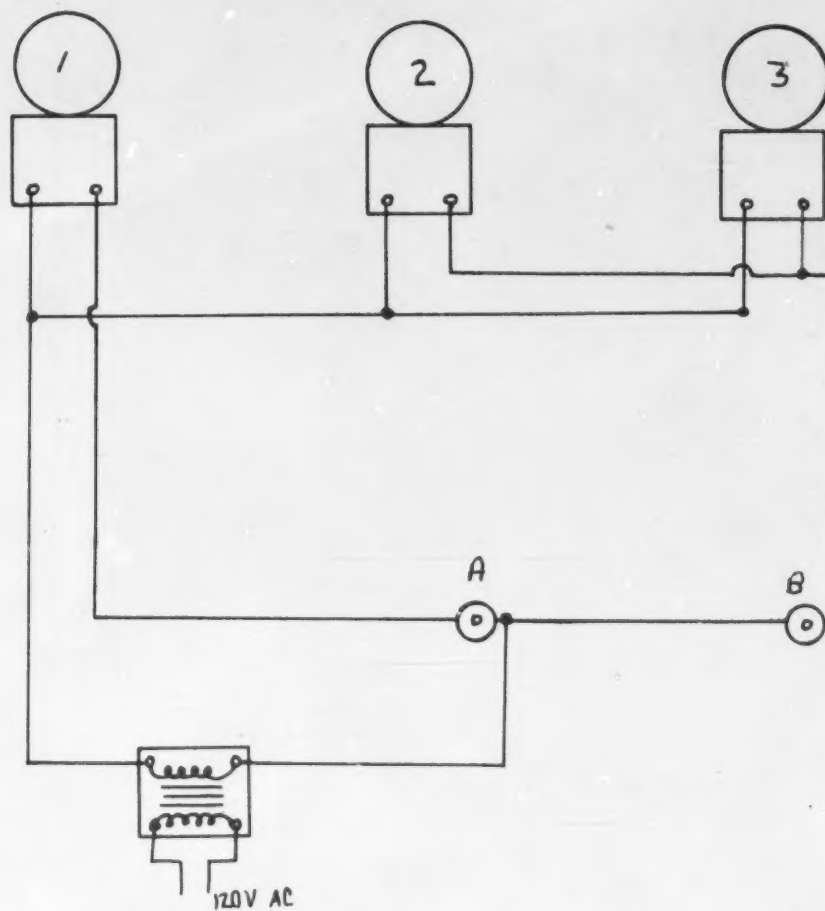
The following bell circuits are to be built on your wiring boards.

Your instructor will grade them after you have completed them.

Draw each circuit on a separate sheet of paper; then build it on your wiring board.



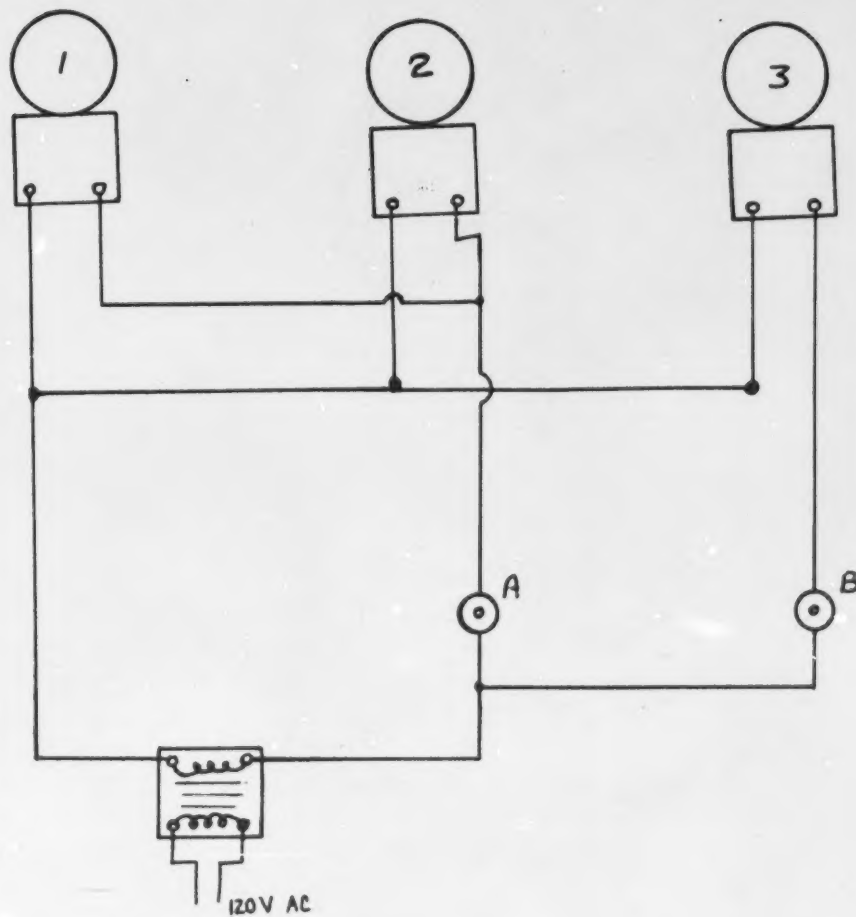
One bell controlled by three pushbuttons.



Three bells connected in parallel, and two pushbuttons.

Pushbutton A controls bell 1.

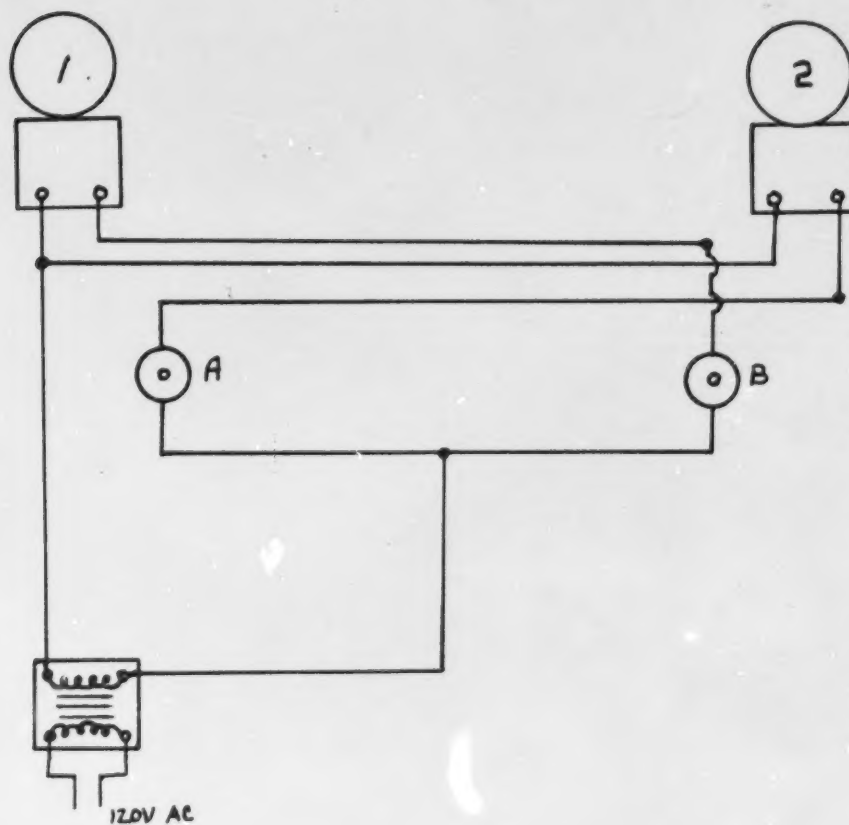
Pushbutton B controls bells 2 and 3.



Three bells connected in parallel, and two pushbuttons.

Pushbutton A controls bells 1 and 2.

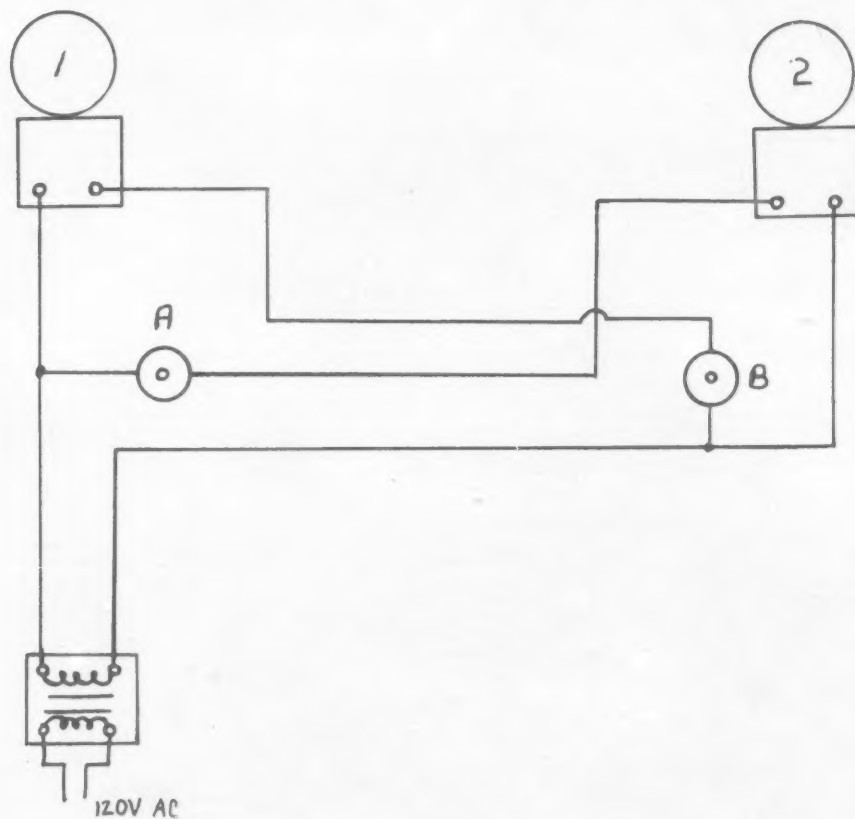
Pushbutton B controls bells 3.



4-Wire return call

Pushbutton A controls bells 2.

Pushbutton B controls bell 1.



3-Wire return call between tw . buildings.

Pushbutton A controls bell 2.

Pushbutton B controls bell 1.